

THAT WHICH IS CLAIMED:

1. A decorative lighting system, comprising:
  - a command controller comprising:
    - a microcontroller for providing a data signal and a clock signal, the data signal including instructions related to a plurality of addresses; and
    - 5 a power supply for providing a power signal;
    - a flexible cord having a first end and a second end, comprising at least two conductors capable of carrying the data signal, clock signal, and power signal, the first end being electrically connected to the command controller;
    - a plurality of illumination devices, each illumination device being
    - 10 disposed between the first end and second end of the flexible cord, each illumination device comprising:
      - a substrate including a first light emitting diode (LED), a second LED, and a third LED, each of the first, second, and third LEDs emitting light at a different wavelength than either of the other LEDs; and
      - 15 an integrated circuit LED driver being electrically interconnected via the at least two conductors to the command controller and responsive to the data signal, clock signal, and power signal for driving the first, second, and third LEDs, the integrated circuit LED driver comprising:
        - a plurality of pulse width modulation registers selectable in
        - 20 combination to drive the first LED, second LED, and third LED independent of one another to a blink rate and an intensity to control the color produced by the combination of the LEDs; and
        - an electronically programmed address circuit for storing an address therein, the integrated circuit LED driver being responsive to the data signal upon
        - 25 receiving a corresponding address from the command controller.
  2. The decorative lighting system according to claim 1, wherein the system further comprises a plurality of command controllers operable as a communication device between the plurality of illumination devices and the microcontroller.

3. The decorative lighting system according to claim 2, wherein the communication device is selected from the group consisting of bus repeaters and multiplexers.
4. The decorative lighting system according to claim 1, wherein the  
5 microcontroller provides the data signal and clock signal according to an inter-integrated circuit protocol (I<sup>2</sup>C).
5. The decorative lighting system according to claim 1, wherein the microcontroller provides the power signal modulated by the data and clock signal.
6. The decorative lighting system according to claim 1, wherein the  
10 integrated circuit LED driver further comprises a brightness register interconnected to the plurality of pulse with modulation registers to at least one of the LEDs for controlling brightness by adjusting a duty cycle of current supplied to the LED.
7. The decorative lighting system according to claim 1, wherein the integrated circuit LED driver further comprises a local oscillator, and a plurality of  
15 prescalers interconnected from the local oscillator to the plurality of pulse width modulation registers to generate multiple periods of the pulse width modulation from the plurality of pulse width modulation registers.
8. The decorative lighting system according to claim 1, wherein the integrated circuit LED driver further comprises an LED select register that controls the  
20 selection in combination of the plurality of pulse width modulation registers.
9. The decorative lighting system according to claim 1, wherein the integrated circuit LED driver further comprises first, second, and third MOSFET gates interconnected to one of the plurality of pulse width modulation registers to gate current to each of the first, second and third LEDs, respectively.
- 25 10. The decorative lighting system according to claim 1, further comprising a fourth LED interconnected to the integrated circuit LED driver to control a blink rate and an intensity of the fourth LED.

11. The decorative lighting system according to claim 10, wherein the fourth LED is disposed on the substrate.

12. The decorative lighting system according to claim 10, wherein the fourth LED comprises a white LED.

5 13. A red-green-blue color managed decorative lighting system, comprising:  
a command controller comprising:

a microcontroller for providing a data signal and a clock signal, the data signal including instructions related to a plurality of addresses; and

a power supply for providing a power signal;

10 a flexible cord having a first end and a second end, comprising at least two conductors capable of carrying the data signal, clock signal, and power signal, the first end being electrically connected to the command controller;

a plurality of illumination devices, each illumination device being disposed between the first end and second end of the flexible cord, each illumination  
15 device comprising:

a substrate including a red light emitting diode (LED), a blue LED, and a green LED; and

an integrated circuit LED driver being electrically interconnected via the at least two conductors to the command controller and responsive to the data  
20 signal, clock signal, and power signal for driving the red, blue, and green LEDs, the integrated circuit LED driver comprising:

a plurality of pulse width modulation registers selectable in combination to drive the red LED, blue LED, and green LED independent of one another to a blink rate and an intensity to control the color produced by the combination of the  
25 LEDs; and

an electronically programmed address circuit for storing an address therein, the integrated circuit LED driver being responsive to the data signal upon receiving a corresponding address from the command controller.

14. The decorative lighting system according to claim 13, wherein the system further comprises a plurality of command controllers operable as a communication device between the plurality of illumination devices and the microcontroller.

5 15. The decorative lighting system according to claim 14, wherein the communication device is selected from the group consisting of bus repeaters and multiplexers.

16. The decorative lighting system according to claim 31, wherein the microcontroller provides the data signal and clock signal according to an inter-integrated circuit protocol (I<sup>2</sup>C).

10 17. The decorative lighting system according to claim 13, wherein the microcontroller provides the power signal modulated by the data and clock signal.

18. The decorative lighting system according to claim 13, wherein the integrated circuit LED driver further comprises a brightness register interconnected to the plurality of pulse with modulation registers to at least one of the LEDs for controlling  
15 brightness by adjusting a duty cycle of current supplied to the LED.

19. The decorative lighting system according to claim 13, wherein the integrated circuit LED driver further comprises a local oscillator, and a plurality of prescalers interconnected from the local oscillator to the plurality of pulse width modulation registers to generate multiple periods of the pulse width modulation from the  
20 plurality of pulse width modulation registers.

20. The decorative lighting system according to claim 13, wherein the integrated circuit LED driver further comprises an LED select register that controls the selection in combination of the plurality of pulse width modulation registers.

21. The decorative lighting system according to claim 13, wherein the  
25 integrated circuit LED driver further comprises first, second, and third MOSFET gates interconnected to one of the plurality of pulse width modulation registers to gate current to each of the red, green and blue LEDs, respectively.

22. The decorative lighting system according to claim 13, further comprising a white LED interconnected to the integrated circuit LED driver to control a blink rate and an intensity of the fourth LED.

23. The decorative lighting system according to claim 22, wherein the white  
5 LED is disposed on the substrate.

24. The decorative lighting system according to claim 22, wherein the white LED comprises a zinc selenide LED.

25. An color tunable illumination device, comprising:  
a substrate including at a first light emitting diode (LED), a second LED,  
10 and a third LED, each of the first, second, and third LEDs emitting light at a different wavelength than either of the other LEDs; and  
an integrated circuit LED driver being electrically responsive to a data signal, a clock signal, and a power signal for driving the first, second, and third LEDs, the integrated circuit LED driver comprising:  
15 a plurality of pulse width modulation registers selectable in combination to drive the first LED, second LED, and third LED independent of one another to a blink rate and an intensity to control the color produced by the combination of the LEDs; and  
an electronically programmed address circuit for storing an address  
20 therein, the integrated circuit LED driver being responsive to the data signal upon receiving a corresponding address from the command controller; and  
an optical diffuser enclosing at least a portion of the first, second, and third LEDs.

26. The illumination device according to claim 25, wherein the integrated  
25 circuit LED driver further comprises a brightness register interconnected to the plurality of pulse width modulation registers to at least one of the LEDs for controlling brightness by adjusting a duty cycle of current supplied to the LED.

27. The illumination device according to claim 25, wherein the integrated circuit LED driver further comprises a local oscillator, and a plurality of prescalers interconnected from the local oscillator to the plurality of pulse width modulation registers to generate multiple periods of the pulse width modulation from the plurality of pulse width modulation registers.

28. The illumination device according to claim 25, wherein the integrated circuit LED driver further comprises an LED select register that controls the selection in combination of the plurality of pulse width modulation registers.

29. The illumination device according to claim 25, wherein the integrated circuit LED driver further comprises first, second, and third MOSFET gates interconnected to one of the plurality of pulse width modulation registers to gate current to each of the first, second and third LEDs, respectively.

30. The illumination device according to claim 25, further comprising a fourth LED interconnected to the integrated circuit LED driver to control a blink rate and an intensity of the fourth LED.

31. The illumination device according to claim 30, wherein the fourth LED is disposed on the substrate.

32. The illumination device according to claim 30, wherein the fourth LED comprises a white LED.

33. A red-green-blue-white illumination device, comprising:  
a substrate including at a red light emitting diode (LED), a blue LED, a green LED, and a white LED monolithically disposed on said substrate; and  
an integrated circuit LED driver responsive to a data signal, a clock signal, and a power signal for driving the red, blue, green, and white LEDs, the integrated circuit LED driver comprising:  
a plurality of pulse width modulation registers selectable in combination to drive the red LED, blue LED, green LED, and white LED independent of

one another to a blink rate and an intensity to control the color produced by the combination of the LEDs; and

an electronically programmed address circuit for storing an address therein, the integrated circuit LED driver being responsive to the data signal upon

5 receiving a corresponding address in the data signal; and

an optical diffuser enclosing at least a portion of the red, blue, green, and white LEDs.

34. The illumination device according to claim 33, wherein the integrated circuit LED driver further comprises a brightness register interconnected to the plurality  
10 of pulse width modulation registers to at least one of the LEDs for controlling a brightness of the LEDs by adjusting a duty cycle of current supplied to the LEDs.

35. The illumination device according to claim 33, wherein the integrated circuit LED driver further comprises a local oscillator, and a plurality of prescalers interconnected from the local oscillator to the plurality of pulse width modulation  
15 registers to generate multiple periods of the pulse width modulation from the plurality of pulse width modulation registers.

36. The illumination device according to claim 33, wherein the integrated circuit LED driver further comprises an LED select register that controls the selection in combination of the plurality of pulse width modulation registers.

20 37. The illumination device according to claim 33, wherein the integrated circuit LED driver further comprises first, second, third and fourth MOSFET gates interconnected to one of the plurality of pulse width modulation registers to gate current to each of the red, green, blue, and white LEDs, respectively.

25 38. An integrated circuit red-green-blue color management LED driver being electrically responsive to a data signal, a clock signal, and a power signal for driving a red LED, a blue LED, and a green LED, the color management LED driver comprising:

a plurality of pulse width modulation registers selectable in combination to drive the LEDs independent of one another to a blink rate and an intensity to control the color produced by the combination of the LEDs; and

an electronically programmed address circuit for storing an address  
5 therein, the integrated circuit LED driver being responsive to the data signal upon receiving a corresponding address in the data signal.

39. The LED driver according to claim 38, wherein the integrated circuit LED driver further comprises a brightness register interconnected to the plurality of pulse with modulation registers to at least one of the LEDs for controlling a brightness of the LEDs  
10 by adjusting a duty cycle of current supplied to the LEDs.

40. The LED driver system according to claim 38, wherein the integrated circuit LED driver further comprises a local oscillator and a plurality of prescalers interconnected from the local oscillator to the plurality of pulse width modulation registers to generate multiple periods of the pulse width modulation from the plurality of  
15 pulse width modulation registers.

41. The LED driver according to claim 38, wherein the integrated circuit LED driver further comprises an LED select register that controls the selection in combination of the plurality of pulse width modulation registers.

42. The LED driver according to claim 38, wherein the integrated circuit LED driver further comprises first, second, third, and fourth MOSFET gates interconnected to  
20 one of the plurality of pulse width modulation registers to gate current to each of the red, green, and blue LEDs, respectively.